MOVING FROM AN UNCERTAIN TO A SUSTAINABLE FUTURE :

ISSUES AND OPPORTUNITIES FACING NOVA SCOTIA

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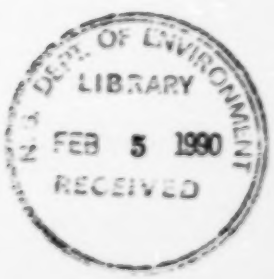

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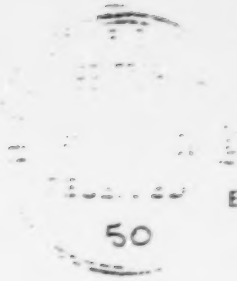

School for
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September 12, 1989

Dr. John Underwood
Department of Environment
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Halifax, Nova Scotia

Dear John:

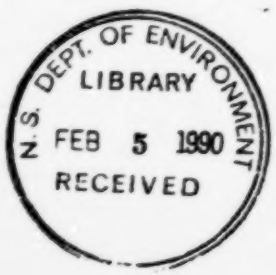
I am pleased to submit the paper which we contracted to produce as a background document for the Conference.

I trust this satisfies the terms of the contract.

Yours sincerely,

Raymond P. Côté
Associate Director

RPC/jt
Encl.



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A Day in the Life of Nova Scotia's Environment

* Concern over the quality and quantity of **fresh waters** in the province has prompted the Minister of Environment to establish a Task Force to examine how to protect uncontaminated lakes, rivers and groundwater and how to clean up waters already polluted. Partly as a result of lower detection limits, increasing numbers of commercial and agricultural chemicals are being found in groundwater.

* **Acid rain emissions** in Nova Scotia reportedly dropped by 15 percent since 1980 but the credit appears to be largely due to plant closures rather than clean-up of continuing sources and efforts at energy conservation.

* The siting and construction of **sanitary landfills** continues as an item of concern on the part of many communities. There has been general displeasure with the operation of many of these facilities, and a call for increased regulation on the transportation of solid waste to the sites and the dumping by individuals.

* Some **rivers** in the province were closed to swimmers and/or use as irrigation water by farmers due to high bacteriological counts. The sources of the contamination tend to be sewage, urban runoff and animal pasture areas. At least, one farmer has considered paying for water treatment to protect his crops. The partial solution to the problem will include properly functioning septic systems and municipal waste water treatment facilities.

* Consultative mechanisms between **fishermen** and the regulatory agency, the Department of Fisheries and Oceans, continue to break down. In a recent case, the majority of fishermen voted against an increase in the minimum lobster size which would conform with U.S. regulations, while the Department claims that the majority supports the move. The conservation aspect of the proposed change appears to have been overlooked.

* There are continuing claims that the **tidal power** plant in Annapolis Royal has caused erosion upstream of the facility, kills unacceptable numbers of fish in its turbines and has damaged the clam fishery in an area downstream of the plant. Though an environmental impact assessment was conducted and the Power Corporation has paid 200 claims, the problems continue.

* New **quarries** are being proposed and constructed in Cape Breton to produce **aggregate** for markets in the United States. These developments provide employment but scar the landscape, place pressure on roadbeds and sometime cause siltation of waterways.

* Problems continue to plague the ground **fishery** with claims of overcapacity, overfishing by Canadians and foreigners, conflict betwen inshore and offshore fisheries and destructive fishing practices. Quotas have been reduced and fishing boats, fish plants and fishing communities will suffer as a result.

* The quality of **beaches**, their long term survival and their flora and fauna are under constant threat due to increasing use and misuse. Calls are being made for increased protection through legal means and education.

• A five year moratorium on **uranium** exploration and mining announced in 1985 will be extended for another five years to permit more study of the issues raised in Judge Robert McCleave's report. One consequence of that decision is that a significant percentage of land is not available for any other mineral exploration.

• Fisherman and **fish plant** workers in southwestern Nova Scotia have demonstrated their dissatisfaction with the current state of affairs with regard to the closure of the inshore fishery by blockading the disembarcation of a ferry which arrived in Yarmouth from the U.S. Civil disobedience of various types is becoming more common in environmental and natural resource issues.

• A fine of $200,000 was levied on a total of two charges against a **foreign fishing** captain for taking fish in Canadian waters. The judge in sentencing the captain indicated that the fine should serve as a deterrent. In another court case involving an appeal against a $6,000 fine levied against a major food processing company for polluting a river and causing a fish kill, the fine was reduced to $4,000. Deterrence was not viewed as an important consideration in this case.

• The Minister of the Environment announced new regulations under the **Environmental Assessment Act** which will ensure that environmental aspects of projects are taken into account during their planning and design and permit public input into the review process for many developments.

• The Department of Environment and Scott Maritimes Ltd. are renegotiating a 19 year old agreement for the treatment of the company's wastes in **Boat Harbour**, a tidal lagoon near Pictou Harbour. As a result of the negotiations, the company will probably pay more to cover operating costs of the facility and replace equipment. There has recently been a call by a local environmental action group to review the whole concept.

TABLE OF CONTENTS

A Day in the Life of Nova Scotia

Introduction

- Defining Sustainable Development
- Criteria of Sustainability

Media Reporting

Environmental and Resource Issues

- Water Quality
  - a) Coastal and Harbour Water Quality
  - b) Freshwater
- Air Quality
- Soil Quality
- Forests, Wildlife and Parks
  - a) Forests
  - b) Wildlife
  - c) Parks and Protected Areas
- Fisheries
  - a) Marine Fisheries
  - b) Aquaculture
  - c) Freshwater Fisheries

Nova Scotians Speak Out About the Issues

Issues and Opportunities for the Future

Conclusion

LIST OF FIGURES, TABLES, AND MAPS

Figure 1 A hierarchical decision-making framework for waste management in the context of environmentally sustainable economic development.

Figure 2 Frequency of Front Page Headlines - Mail Star 1980-1989.

Figure 3 Frequency of Front Page Headlines - Mail Star 1988.

Figure 4 Trends in the number of shellfish closures in the Maritime Provinces.

Figure 5 Nitrogen Oxide 24 Hour Annual Mean - Halifax (Barrington - Duke).

Figure 6 Suspended Particulate Matter 24 Hour Annual Mean - Sydney Whitney Pier.

Figure 7 Ozone 24 Hour period Shearwater.

Figure 8 Atmospheric Pollution.

Figure 9 The apparent relationship of fish and shellfish stocks and fishing/processing capacity.

Table 1 Some Headlines of the Chronicle Herald/Mail Star during the period 1979-1989.

Table 2 Contamination sources responsible for shellfish growing area closures in the Maritime Provinces 1987.

Table 3 Surface and Groundwater Testing 1986-1988.

Table 4 Wastewater Treatment 1981 and 1986.

Table 5 Forest Ownership in Nova Scotia.

Table 6 Land Use in Nova Scotia.

Table 7 Cost of Environmental Deterioration and Enhancement in Nova Scotia.

Map 1 Water Quality Problems in Nova Scotia.

Map 2 Parks in Nova Scotia.

Appendix A Consumption Patterns in Nova Scotia.

- Table i) Population of Nova Scotia
- Table ii) Provincial Gross Domestic Product
- Table iii) Registry of Motor Vehicles in Nova Scotia
- Table iv) Sale of Alcoholic Beverages by Volume
- Table v) Total End Use Energy Consumption in Nova Scotia
- Table vi) Halifax Water Consumption per capita per day
- Table vii) Future Waste Generation

MANAGING PLANET EARTH

"Although efforts to manage the interactions between people and their environments are as old as human civilization, the management problem has been transformed today by unprecedented increases in the rate, scale and complexity of those interactions. What were once local incidents of pollution now involve several nations. What were once acute episodes of relatively reversible damage now affect multiple generations. What were once straight forward confrontations between ecological preservation and economic growth now involve multiple linkages."

William C. Clark
Harvard University, 1989

INTRODUCTION

This paper could have been written from several different perspectives. An issues framework could have been utilized in which topics such as acid rain, pesticides, industrial chemicals, and marine pollution were discussed. A media approach could also have been used addressing the quality of air, water, soil and biota. An ecosystem framework might also have been the basis for the paper with a focus on watersheds, coastal, offshore and urban areas. Finally, a geographic/jurisdictional approach might have been utilized in which Cape Breton, Southwest Nova Scotia, the Annapolis Valley as examples, could have been discussed. A resource based approach was selected because of the importance of those renewable resources to Nova Scotia's way of life, culture and industrial base. They reflect in many ways, our ability to sustain development and conserve the environment and its natural resources for the benefit of future generations.

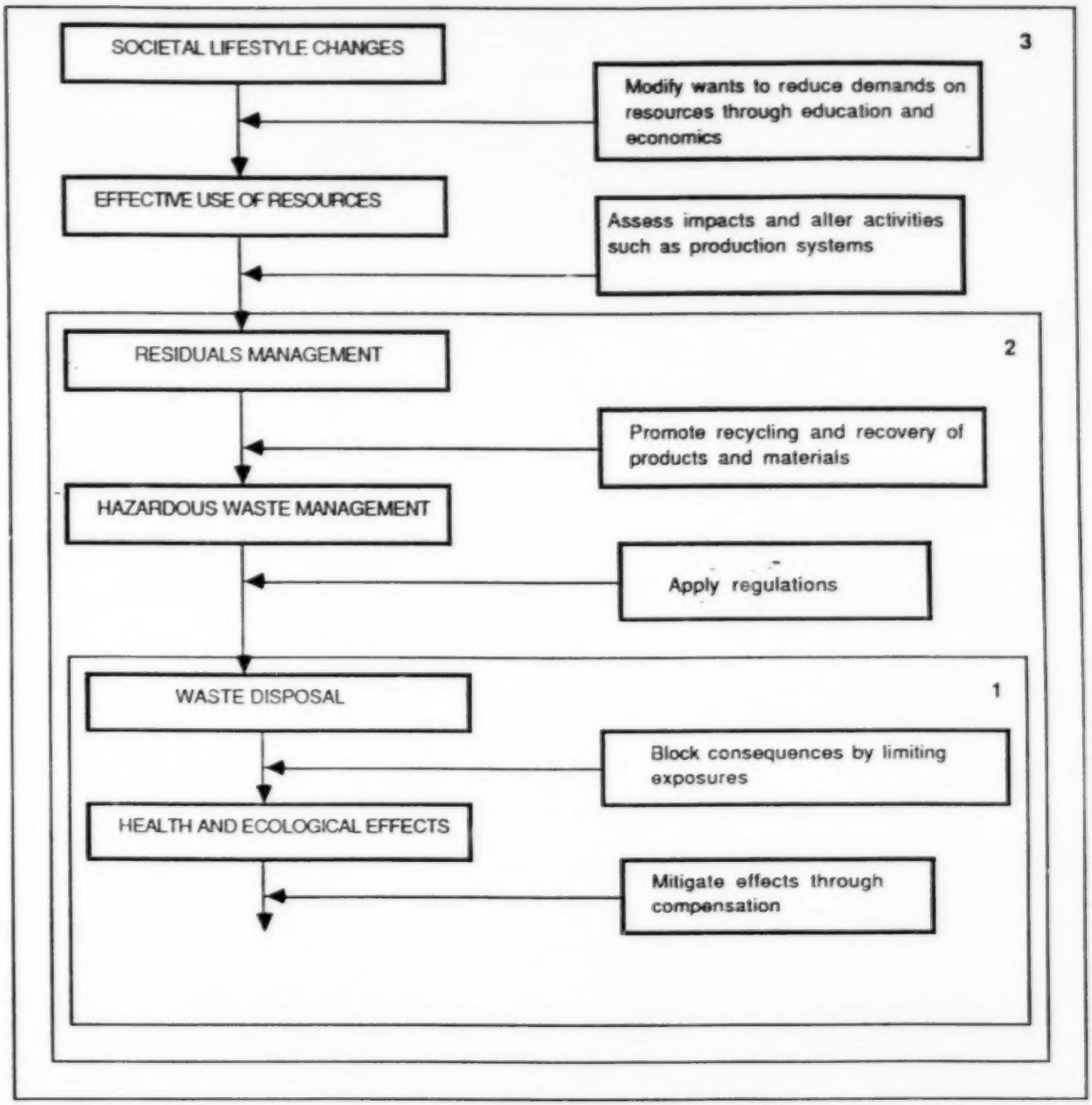
It is a formidable task to review the issues facing Nova Scotians as they attempt to manage renewable resources on a sustainable basis, make the most effective use of non-renewable resources and maintain environmental quality at an acceptable level. This paper will raise some questions which continue to plague us as we proceed down a road which, hopefully, will safeguard the interests of future generations, our children and their children. It has not been possible to address all resources, all pollution problems, all issues. Therefore, this paper emphasizes water quality, air quality, soil quality, fisheries and forestry. Many of the issues facing us are inextricably linked, though the linkages are not always recognized.

Defining Sustainable Development

The first sentence of the second paragraph includes three words which are at the heart of the current debate. The words are "sustainable", "effective" and "acceptable". "Sustainability" as a concept has been with us for a long time in many forms. The message was first presented at the Stockholm Conference on the Human Environment in 1972 but the emphasis at the time was on environmental protection, perceived by many as control on industry and hindering development. In the mid seventies, the notion of a conserver society was promoted with its emphasis on conservation; this was perceived by many as a promotion of preservation and in the eyes of some as preventing development. Then along came the ideas of integrated management, such as coastal zone management and river basin planning. The need for greater integration of development objectives and uses was being recognized but in Canada, the implementation of such approaches was viewed as too cumbersome and inefficient. The consequence, it has been argued, would be an increase in development costs.

The World Commission on Environment and Development, also known as the "Brundtland Commission" after the Norwegian Prime Minister who chaired it, has been credited with finding a concept, an approach which finally blends economics and environment in balance with one another. Readers of "Our Common Future" and this paper should recognize that sustainable development actually encompasses the three concepts described above and has added other notions. Sustainability necessitates environmental protection, conservation of resources, integrated planning and management, and changes in our values and way of life. (Figure 1)

Figure 1. **A hierarchical decision-making framework for waste management in the context of environmentally sustainable economic development. The framework can be used by industry, government and individual consumer**


SOCIETAL LIFESTYLE CHANGES
3
Modify wants to reduce demands on resources through education and economics
EFFECTIVE USE OF RESOURCES
Assess impacts and alter activities such as production systems
RESIDUALS MANAGEMENT
2
Promote recycling and recovery of products and materials
HAZARDOUS WASTE MANAGEMENT
Apply regulations
WASTE DISPOSAL
1
Block consequences by limiting exposures
HEALTH AND ECOLOGICAL EFFECTS
Mitigate effects through compensation

1. **ENVIRONMENTAL PROTECTION**
2. **ENVIRONMENTAL MANAGEMENT**
3. **SUSTAINABLE DEVELOPMENT**

First and foremost, sustainability must be assessed in ecological terms because ecosystems and renewable resources are the underpinnings of development. But sustainability must also be viewed in social and economic terms in large part because

there is a long tradition of use of these qualifiers of development by people. This is not to say that traditional economic and sociological measures are adequate. In fact, it is becoming clear that the current approach is short-sighted, fragmented and narrow. In effect, the true costs of development have never been accounted for when financing has been sought.

Criteria of Sustainability

What then are the criteria of sustainability? Some of the following seem to be appropriate:

- activities that do not alter ecological processes irrepairably;
- activities that do not result in the loss of species beyond the natural evolutionary process;
- activities that provide a return to investment (where investment includes capital, non-renewable and renewable resources, people);
- activities that can be assimilated without interfering unreasonably with other uses;
- activities which strengthen local capacity to provide;
- development which is comprehensive and where possible integrated;
- development which provides opportunities for people potentially affected to participate in planning and implementation;
- activities which make effective use of resources through improvements in waste management (minimization, recovery, recycling, treatment);
- activities which improve the quality of life as measured by social, ecological and economic indicators;
- development in which resource and environmental quality is factored into measurements of growth accounting;

The Brundtland Commission has forced us to recognize that economics and ecology are really dealing with the same house (with roots in the Greek 'oikos'). Ecology is the study of the relationship of organisms and their physical, chemical and biological environment, essentially, understanding the house in which we live. Economics is concerned primarily with the description and analysis of the production, distribution and consumption of goods and services, in effect, the management of the house. Effective use of goods and services involves the realization that their production, distribution and consumption have environmental implications, and the incorporation of the environmental costs in prices and taxes.

Finally, the criterion of acceptability as a measure of environmentally sound development has been gaining momentum for many years. It has been enshrined in Nova Scotia's environmental assessment legislation and recently promulgated regulations. But public hearings on development projects are not the only means of determining acceptability. Ways must be found to enable people to make informed choices, in the words of the World Commission, "making difficult choices.... will depend on the widespread support and involvement of an informed public and of non-governmental organizations, the scientific community, and industry".

Development will continue and it must continue. We cannot stand still but we cannot follow our current path without great risks to our health, our fisheries, our coastal waters our climate and the economic sectors dependent on it. This paper is an attempt to raise questions about the nature of development in Nova Scotia.

MEDIA REPORTING ON ENVIRONMENT 1980-1989

Though it is possible to reconstruct a history of significant environmental issues by interviewing selected individuals, press clippings were selected as a more readily available archive. The scope and quantity of media reports on environment and natural resource issues can be analyzed from a number of perspectives. As a representation of the public's concern, media coverage indicates what the public identifies as important issues. Given that many environmental stories originate either as government or industry press releases they can also be said to reflect public opinion in an indirect sense. And finally the incidence of environmental reporting must also be recognized as a rough indicator of the public's perception of the degree of environmental deterioration.

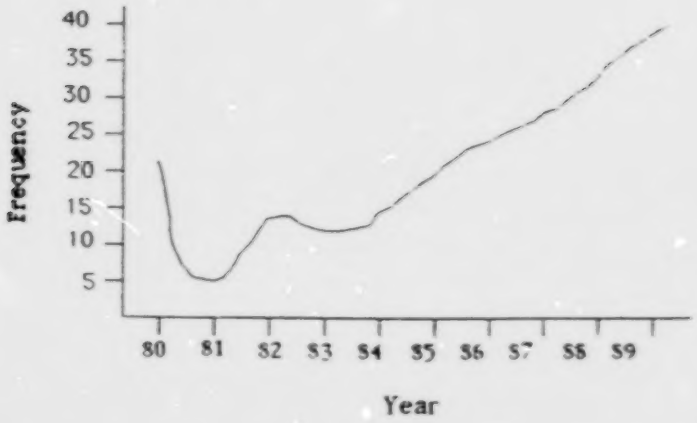
The media, in terms of the news it reports, is both a follower and a leader. The media is one avenue through which the public is educated about environmental and resource issues. Increased public knowledge should result in the demand for more sophisticated analysis of the issues as well as more expressions of concern for the environment. As a result positive feedback is created between the media and the public it serves: as the media reports more the public demands more in terms of quantity and analysis.

The Mail Star, the major daily newspaper in Nova Scotia, was analyzed from 1978 to May 1989 to identify issues which received the most coverage during that period. This analysis revealed interesting trends in general public concern for environmental issues, the degree of analysis, and the relationship between environmental concern and other current events and issues.

At the most basic level, the increasing number of front page headlines concerning environmental issues from 1980 to 1989 (1978 to 1980 was not included as the front page was in a different format) reflects a growing concern among Nova Scotians for the environment, see Figure 2. Inside coverage can also be assumed to follow the same trend and it is noteworthy that there have been many more editorials on environmental issues in the past twelve months. The decrease in coverage from 1980 to 1983 may be due to the preoccupation with economic issues characterized by that period but should not be interpreted to indicate that environmental problems were not significant.

Figure 2

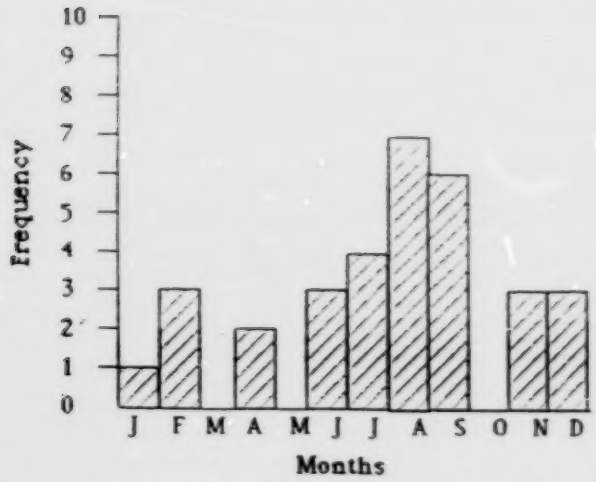
Frequency of Front Page Headlines - Mail Star 1980-1989



It is interesting to note that environmental reporting increased significantly before the provincial election of 1988, see Figure 3. The political profile of the environment and risks facing it is a reflection of the public's concern for the quality of environment and conflicts over resources use. The press, in turn, reflects this.

Figure 3

Frequency of Front Page Headlines - Mail Star 1988



More specifically, an analysis of the issues covered over the past ten years reveals important issues with significant lifespans but which eventually are replaced by other concerns; as well as some acute problems, and finally continuing problems. Important concerns over the past decade are represented in the headlines in Table 1.

FISHERY: GREAT POTENTIAL
FEBRUARY 20, 1979

ENERGY IS TOP PRIORITY
FEBRUARY 29, 1980

HERBICIDE COURT BATTLE STARTS
MAY 6, 1983

FOREST INDUSTRY IN PERIL
DECEMBER 15, 1984

PACT MADE TO FIGHT ACID RAIN
FEBRUARY 6, 1985

TOXICS FOUND IN WATER
JUNE 2, 1986

HALIFAX HARBOUR OPEN SEWER
JULY 12, 1986

THE TAR PONDS
OCTOBER 1, 1988

POLLUTION SAID HEALTH ISSUE
JUNE 6, 1988

POWER PLANT EMISSIONS UNDER FIRE
FEBRUARY 14, 1989

OVERFISHING BLAMED FOR NATSEA CLOSINGS
MAY 12, 1989

HARBOUR CANCER CESSPOOL - STUDY

Table 1 Some Headlines of the Chronicle-Herald/Mail Star during the period 1979-1989

STRATEGIES FOR MANUFACTURING

"The incentive for industry is clear: Companies will be able to minimize costs and stay competitive while adhering to a rational economy approach that accounts for global costs and benefits. Equally clear are the benefits to society at large: People will have a chance to raise their visible standards of living without incurring hidden environmental penalties that degrade the quality of life in the long run. Remembering that people and their technologies are part of the natural world may make it possible to imitate the best workings of biological ecosystems and construct artificial ones that can be sustained over the long term."

R.A. Frosch and N.E. Gallopoulos
General Motors, 1989

The single most important issue as evidenced by its coverage over the period surveyed is water quality. The original emphasis in the coverage of water quality was on acute problems such as localized areas of groundwater contamination but this has shifted to surface and coastal water quality deterioration throughout the province. The persistence of this issue is indicative of people's concern as well as the deterioration of the resource and therefore signals the pressing need for action. The Minister's Task Force on Water is a reflection of the increasing concern. There has also been a continuous concern expressed regarding the state of our forests and fishery. Given their importance to the Nova Scotian economy and way of life this is understandable. It is important to note that water quality is an important aspect of both these sectors but from quite different perspectives. Concern continues to be expressed about the impact of forestry practices, use of pesticides on water quality. From a fishery perspective good water quality is essential to maintain freshwater fish populations, permit harvesting of shellfish in coastal waters, and expand aquaculture opportunities.

An analysis of not just what is reported but how and why reveals an increasing sophistication in analysis of the issues paralleling an increasing sophistication in the general understanding of the issues by the public. Increasingly events are reported and become issues due to direct public pressure. Environmental reporting is influenced to a lesser degree by public relations press releases though such releases are increasing. Incidents are no longer only reported as factual independent events but some analysis as to the why and how of the occurrence in a larger context is undertaken. Such analysis is still limited in Nova Scotia but it is beginning to introduce the concepts of integrated environmental management, land use planning, and sustainable development to the public. A recent series of reports in the Chronicle-Herald from the Ecology 89 Conference in Sweden is an example. There remains a need to guard against misinformation such as occurred in an August 25 headline stating that Halifax Harbour was a "cancer cesspool". This slow shift in coverage from an event by event basis to a more holistic analysis reflects the same movement in perception and action, in all corners of society.

ENVIRONMENTAL AND RESOURCE ISSUES

The increasing press coverage, the formation of new environmental groups and the attention to environmental problems by politicians at all levels in Nova Scotia is a sign that environment has become as important an issue as it has elsewhere in Canada and other industrialized countries. Governments have responded with new policies in the areas of forestry, parks, fisheries and wildlife habitat, and new laws and regulations to manage hazardous wastes, pest control products and the environmental impacts of development projects. Individuals have demonstrated their increasing commitment by promoting and supporting recycling programs. Industries are becoming sensitized and are responding by participating actively in the Environmental Economy Committee of Voluntary Planning, and in the planning of this conference. Clearly substantial progress has been made, but environmental problems and resource conflicts continue to occur.

1. WATER QUALITY

Water is the medium of life and without clean sources of water to support us and the natural resources we depend on, our way of life will be drastically altered. Nova Scotia license plates with their phrase "Canada's Ocean Playground" indicate the importance of water for our own recreational pursuits as well as for the many tourists who flock to the province each year. Contrary to what many of us may believe, Canada and Nova Scotia do not have an inexhaustable supply of reasonably available, clean fresh water and there are increasing reports of marine environmental quality problems both along the coast and offshore. It appears that marine, surface, and groundwater quality in the province is deteriorating, though we have limited comprehensive information on the state of our waters. (See Map 1.) The problem has been recognized by government and the Minister of Environment recently established a task force to assess its nature and extent. As was the case with the Minister s Task Force on Hazardous Wastes, it is hoped that the work of the task force will raise awareness throughout the province, identify strategies on a sectoral and watershed basis to better manage aquatic resources, and finally, identify the need for an improved regulatory system.

For the individual, water quality problems are increasingly being linked with health issues and this relationship has, in turn, raised the profile of the problems. A brief list of these concerns would include groundwater contamination both natural and through industrial and agricultural chemicals, shellfish closures, swimming closures, and crop irrigation with contaminated water. It should be evident that water quality enhancement in Nova Scotia is of the utmost importance because of its potential impact on human health, fisheries, agriculture and tourism.

a) Coastal and Harbour Water Quality

With respect to coastal and marine water quality there are two broad problems: the contamination of inshore waters through a number of pollution discharges and the soiling of our beaches, shores, and water with garbage, particularly plastic. The province has many coastal "hot spots" where environmental quality has deteriorated to the point where it represents a health hazard and/or can no longer support healthy marine life. The most prominent of these spots are Halifax Harbour and Sydney Harbour. Both are to be the recipients of massive clean-ups funded through municipal/provincial/federal agreements. Halifax Harbour has been reported as an "open sewer" and a "cancer cesspool" due to the spilling of raw sewage and commercial wastes into the harbour since the existence of Halifax/Dartmouth. Before a treatment facility is operational at least 25 million more gallons of untreated sewage will enter the harbour each year and there is an indeterminate amount of industrial effluent and hazardous waste entering the harbour. This has resulted in highly contaminated but localized sediments with unacceptable levels of mercury in some areas, swimming closures and unsightly garbage floating in the harbour and washing onto shore.

Sydney also dumps untreated sewage into its harbour but of greater concern is the tar ponds, once a scenic inlet now the largest chemical waste site in Canada. The tar ponds were created through the unregulated emissions from Sydney Steel's coke ovens and former tar plant. They contain an unacceptable level of polynuclear aromatic hydrocarbons, some of which are known cancer-causing agents. The clean-up of this site is estimated to take ten years and cost 50 million dollars.

MAP 1 - WATER QUALITY PROBLEMS
IN NOVA SCOTIA
Bacteriological Contamination
X Chemical Contaminations
Areas susceptible to pesticide
and fertilizer contamination
Contamination due to road salt

Other sites include the Strait of Canso, Pictou and Boat Harbours and Petit de Grat. In the Strait of Canso testing by Environment Canada from 1979 to 1983 of fish in the effluent produced by Stora Forest Industries Limited resulted in a survival rate in the range of 2.4 to 4.2% (Mail Star 1988). The effluent of some pulp and paper mills are believed to contain levels of dioxin, a highly toxic chemical, produced during the bleaching process. The quantity and quality of fish is decreasing in the strait as a result. This state of affairs is "acceptable" because Stora was built before 1971 and is, therefore, exempt from federal pulp and paper regulations.

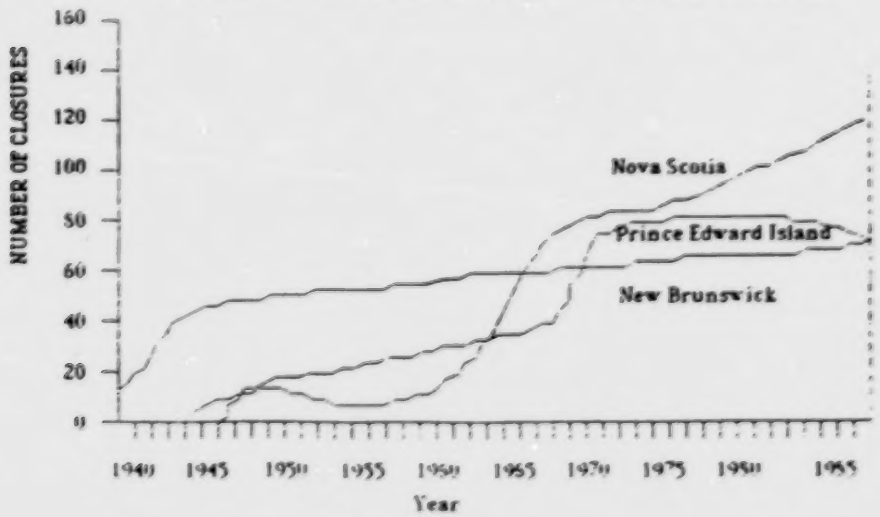
Boat Harbour in Pictou County is another water body which has been the subject of debate since it was designated as a treatment system nineteen years ago. The debate has focussed on the appropriateness of the use of a tidal lagoon as a treatment plant as well as on the degree of treatment achieved. What was once a productive marine estuary is now a lagoon containing wood fibres, sodium sulphate, and chloride from Scott Maritimes Ltd. kraft pulp mill. The provincial government recently announced that it was negotiating with Scott to improve the system (Mail Star, 1988).

Finally, smaller harbours have not escaped unscathed. As an example, Petit de Grat harbour has severely contaminated sediments. PCBs apparently from fish are concentrated in the fish meal effluent and result in sediment contamination as high as 20 ug/g dry weight. There are at least eighteen other harbours in Atlantic Canada with PCB sediment concentrations greater than 1 ug/g (Eaton et al. 1986). The Ocean Dumping Control Act gives a limit of 0.1 ug/g sediment concentration and thus controls are placed on the ocean disposal of polluted sediments.

The deterioration of coastal waters is evidenced by shellfish closures in the province. Shellfish closures are utilized to prevent disease through the consumption of contaminated shellfish. Presently the total number of closures is 160. This number has been increasing since the 1960's, see Figure 4. More area has been surveyed however there has been no reduction in closure numbers indicating that coastal water quality has not improved. Table 2 shows contamination sources responsible for shellfish growing area closures in the Maritime provinces since 1987. It is worthwhile to note that municipal discharges are entirely responsible for 19.7% of all shellfish closures and that they are implicated in the closing of over 50% of contaminated shellfish areas.

Fig 4

Trends in the number of shellfish closures in the Maritime Provinces



Source. Menon, A.S. 1988

TABLE 2

Contamination sources responsible for shellfish growing area closures in the Maritime Provinces 1987

Pollution Sources	No. of Closures	Percentages of total closures
Multiple discharges	189	61.0
Municipal discharges	61	19.7
Agricultural/rural runoff	40	12.9
Industrial wastes	16	5.1
Wildlife	4	1.3
Total	310	

Source: Menon, A.S. 1988

It is also important to recognize that non-point sources of pollution such as agricultural run-off, urban and rural run-off, boats, wildlife, and dredging activities contribute in whole or in part to fifty percent of closures in Atlantic Canada (Menon, A.S. 1988). Non-point sources are more difficult to regulate. Shellfish closures and the trend toward increasing closures are very costly from an economic and social point of view. While it is difficult to provide detailed costs on foregone economic opportunities, healthy coastal waters could mean millions for the province of Nova Scotia (Menon A.S. 1988). One of the province's developing industries is strongly influenced by the quality of coastal waters. Ironically, while aquaculture depends on good quality water for growth of the animals and marketability of the product, the activity itself has the potential to influence water quality. Careful consideration must be given to the assimilative capacity of coastal waters when siting aquaculture facilities otherwise excess fish food and waste products could cause quality to deteriorate, affecting the viability of the industry itself.

Finally there is an increasing concern over the garbage that is washing ashore on our beaches. The concern is related to the growing incidence of beaches strewn with garbage, mostly plastic. The source of this plastic are pleasure boaters, fishermen, and people living along the shore. Not only is this garbage unsightly but if swallowed by birds and marine mammals it often proves fatal.

b) Freshwater

Groundwater and surface freshwater also appear to be deteriorating. As discussed previously surface waters are affected by siltation, agricultural run-off, poor or non-existent sewage treatment, and acid precipitation. They can also be affected by discrete events such as chemical spills and pesticide spills which have resulted in fish kills. Groundwater represents the domestic supply for fifty percent of the population while ninety-four percent of the population serviced by public water systems uses surface waters (Eaton et al. 1986).

Groundwater in Nova Scotia can be contaminated through natural sources such as arsenic and uranium and it can also be contaminated by synthetic chemicals through spills or faulty storage and disposal, leaking sewer systems, salt from roads, nitrates from agricultural fertilizers and acids and metals from mining activities. Nitrates in groundwater are a growing concern. The incidence of ground and surface water testing has been increasing (See Table 3). This increase is the result of greater regulation and greater concern on the part of the public and government. It is not clear at this time whether the information base can document the rate of deterioration.

TABLE 3 SURFACE AND GROUNDWATER TESTING 1986-1988

Year	Nitrate Tests	Total Tests
1986	7,428	203,504
1987	8,750	239,714
1988	11,513	315,165

Source: Environmental Chemistry Lab. Victoria General Hospital. Halifax, Nova Scotia

Past and present methods of garbage disposal also threaten surface and groundwater. In the past disposal sites were often in close proximity to or directly in watercourses. An abandoned waste disposal site study in 1987 identified 15 high priority sites out of 172 sites studied. Fourteen of these sites were identified as high priority because of their proximity to the water table and groundwater, therefore, their potential for contamination (Nova Scotia Department of the Environment 1987).

It is obvious that clean water is necessary for our own health, the health of our natural resources, and for a healthy economy. Because of the role of sewage in all types of water contamination the improvement and establishment of wastewater treatment facilities for all communities in the province must be of the highest priority. Table 4 compares the nature of wastewater treatment facilities in Nova Scotia in 1981 and 1986. Recent reports indicate that the state of many of these facilities, in terms of size and operation, is inadequate to treat the wastes being collected.

TABLE 4 WASTEWATER TREATMENT 1981 AND 1986

				Type of Facility			
Year	Population	Served Population	#of Towns	Primary	Lagoon	Secondary	None
1981	522,954	128,813	103	-	16	64	23
1986	548,993	176,714	113	1	21	72	19

Source: National Inventory of Municipal Waterworks and Wastewater Systems in Canada. 1981 and 1986.

2. AIR QUALITY

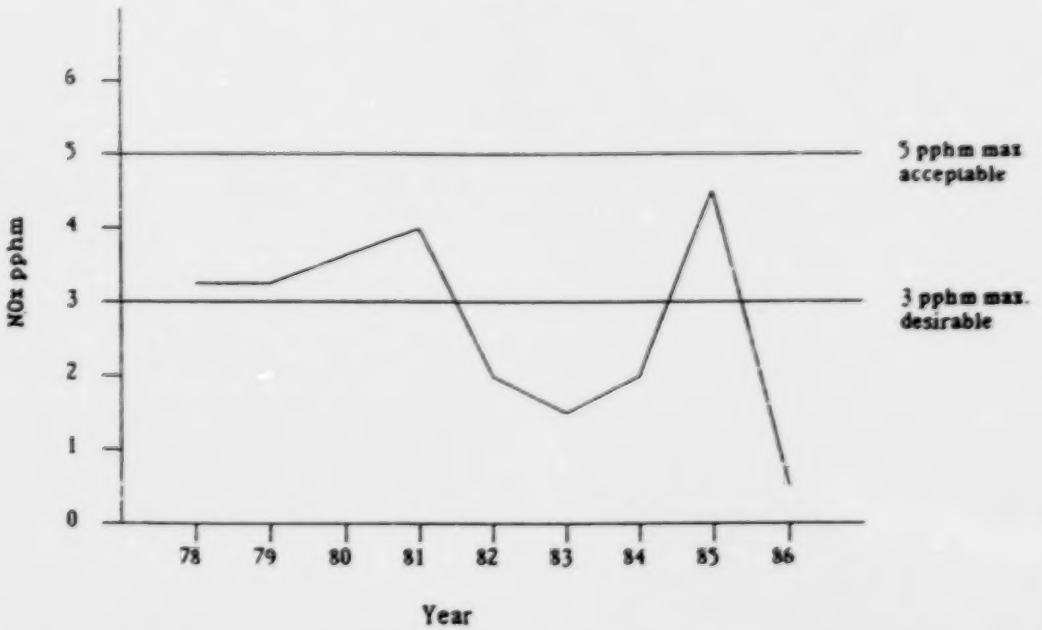
As determined by measurements of conventional contaminants in the ambient air by the National Air Pollution Surveillance (NAPS) network, air quality in Nova Scotia is generally improving. NAPS measures sulphur dioxide, carbon monoxide, nitrogen oxides, ozone, suspended particulates and lead, however, not all substances are measured at each site in Nova Scotia. Sites are located only in the Halifax/Dartmouth area, Sydney, and Glace Bay. Therefore, it is important to note that the generalization about improvement is based only on a few indicators and a few sites.

Sydney has the worst air quality in Nova Scotia often exceeding acceptable limits for certain substances, particularly suspended particulates and PAHs, in a one hour or twenty-four hour period. These can be attributed to the Sydney Steel plant. However, on an annual basis most emissions in Sydney are within acceptable limits (Eaton et al. 1986).

Across the province from an annual point of view ozone is the only monitored substance which exceeds acceptable limits. Ozone is a secondary pollutant formed by a chemical reaction between hydrocarbons and nitrogen oxides. High ozone levels in Nova Scotia are believed to be due to the long range transport of the substance, with local emissions playing a relatively minor role in its occurence (Eaton et al. 1986). Ozone has known adverse effects on vegetation, man-made materials and human health. Figures 5, 6 and 7 illustrate the annual means at the locations with the highest monitored concentration for nitrogen oxide, suspended particulates, and ozone in Nova Scotia. The means are measured against the National Ambient Air Quality Objectives. There are no objectives for carbon monoxide and particulate lead.

Figure 5

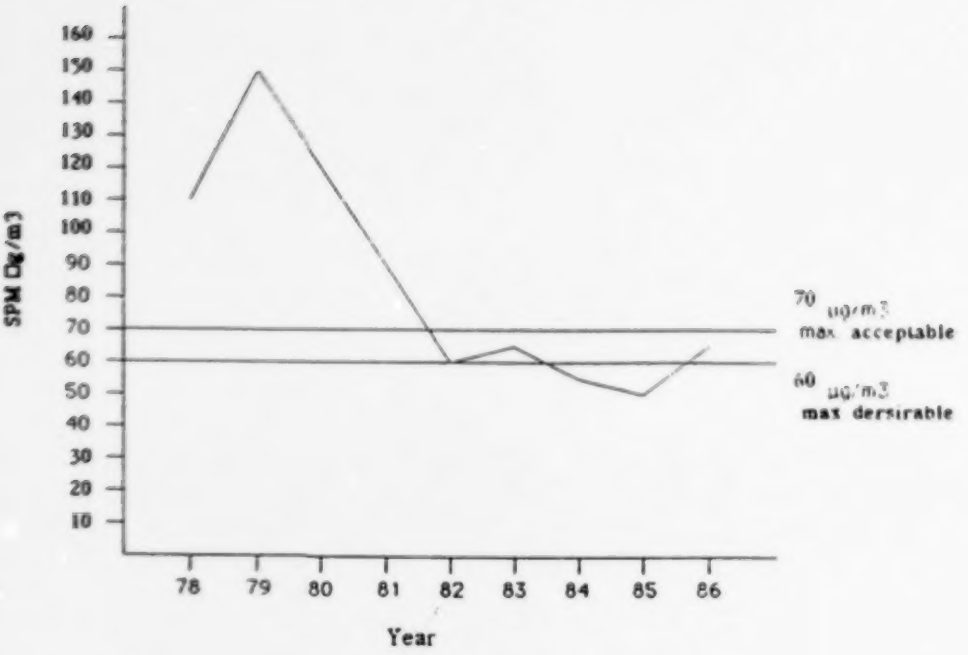
Nitrogen Oxide 24 hr. Ann. Mean Halifax (Barrington & Duke)



Source NAPS

Figure 6

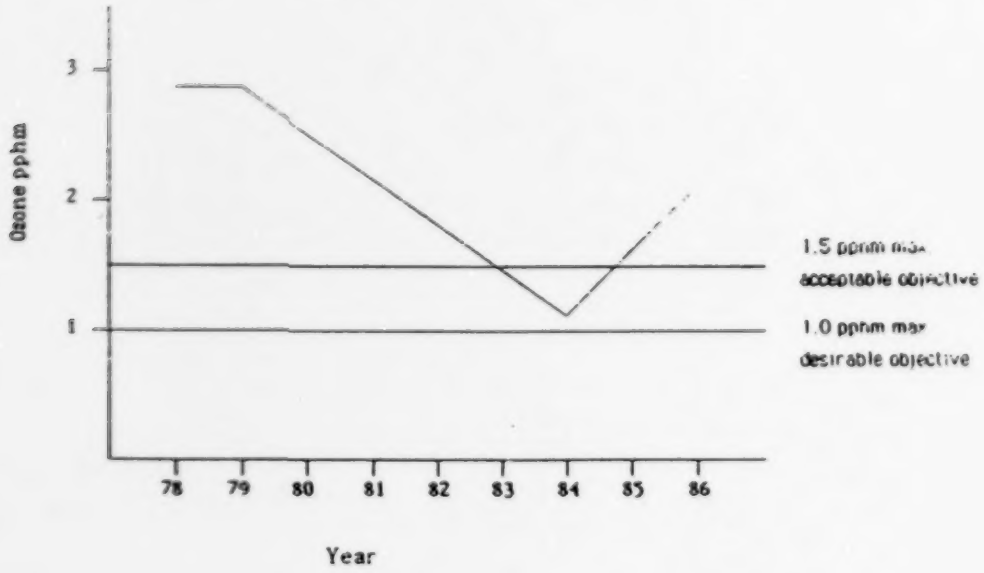
Suspended Particulate Matter 24 hr. Ann. Mean Sydney Whitney Pier



Source NAPS

Figure 7

Ozone Annual Mean 24 hr. period Shearwater, N.S.



Source Natural Air Pollution Surveillance
Environment Canada

STRATEGIES FOR ENERGY USE

"It is the collective response of developing countries to opportunities for efficient resource use in their economies that will determine humanity's ultimate success in slowing the deterioration of the global environment. New technology can help less developed countries to leap over the undesirable practices of the past and follow new energy paths for development. The industrialized world and developing countries must work together to ensure that opportunities are available and, where sensible, are accepted."

John H. Gibbons, Peter D. Blair and Holly L. Gwyn
Office of Technology Assessment, U.S. Congress, 1989

In recent years, the most important issue relating to air quality in Nova Scotia has been acid precipitation. It is due to the emission of sulphur dioxide and nitrogen oxides through the combustion of fossil fuels. Acid precipitation has been linked to the deterioration of man-made structures in the province, of particular importance is the deterioration of historical structures in urban areas. Acid precipitation also contributes to the acidification of surface waters. The acidification of lakes in the vicinity of Halifax/Dartmouth is directly linked to local emissions (Shaw R.W. 1982). The acidification of surface waters in poorly buffered regions of Nova Scotia, particularly in the southwestern portion of the province, has resulted in a close to fifty percent loss in Atlantic Salmon reproduction capacity (Watt, W.D. 1986). There is no conclusive field evidence of adverse effects on our forests from acid precipitation as has occurred in other parts of North America but concern has recently been raised about deterioration of maple trees in Cape Breton and central Nova Scotia.

pH levels are improving and acidification effects across the province have stabilized (Barbour, S. 1989). However, it is believed that improvements in lakes already acidified will occur only if at least a fifty percent reduction in emissions occurs. It is hoped that such a reduction would result in a slow but positive response by plants and animals (Environment Canada 1988).

Acid precipitation in the province is due to local emissions as well as to the long range transport of air pollutants (LRTAP). Nova Scotia's energy policy with its commitment to energy self-sufficiency and the substitution of indigenous resources, particularly local coal, for imported oil has implications for the success of reducing acid precipitation. Nova Scotian coal has a higher sulphur content than other Canadian coals however the province has signed an agreement (Acid Rain Abatement Program) with the federal government to ensure loadings of sulphur dioxide are no greater than twenty kilograms per hectare per year by 1994. This requires a reduction in total provincial emissions to 204,000 tonnes by 1994. Adherence to this agreement should ensure that Nova Scotia meets current objectives. It is, however, possible that loadings may be revised downward in the future due to part to the cummulative stress on ecosystems caused by the many air pollutants.

While much of the concern in the past ten years focused on sulfur dioxide and nitrogen oxides in relation to acid rain, and more recently the relationship of chlorofluorocarbons to ozone depletion in the stratosphere, the situation is now more complex. "Toxic rain" has been introduced by scientists to explain the long-range transport of chemicals into areas where they would not normally be expected. And global warming is now viewed by scientists, and increasingly by politicians and industrialists, as a problem of potentially greater magnitude. The situation is complicated because many of the same gases contribute to several atmospheric pollution problems including ground level ozone contamination, global warming, acid rain and stratospheric ozone depletion (see Fig. 8). The number of gases and sources contributing to these problems has also been broadened. These gases include carbon dioxide, carbon monoxide, nitrous oxide, methane, chlorinated hydrocarbons such as chloroform and carbon tetrochloride. Increases in one problem area, such as global warming is also predicted to exacerbate another, namely ozone production. Finally the mitigation strategies and technologies which are selected to address one kind of problem could conceivably lead to the further deterioration of another problem.

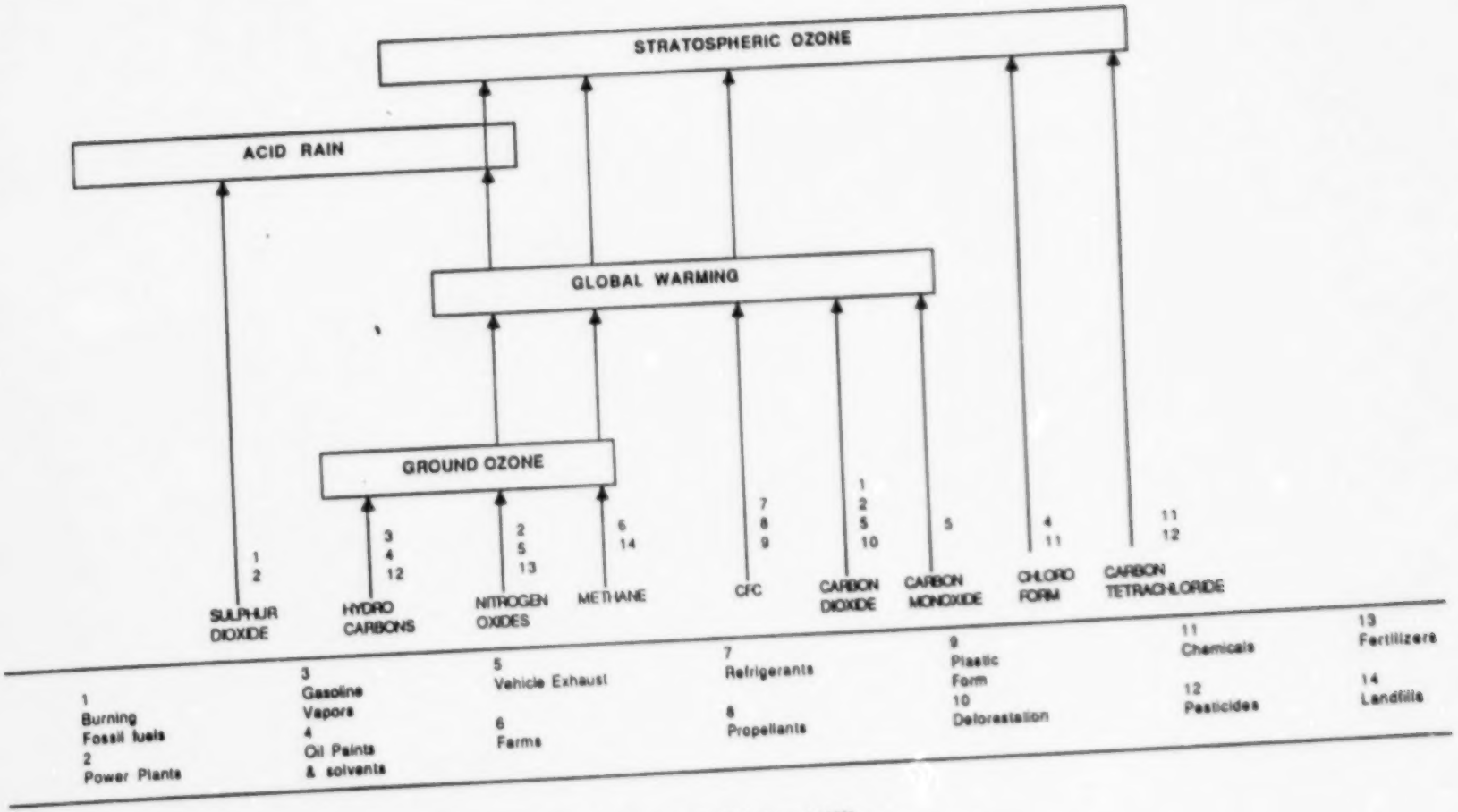


Figure 8. Atmospheric pollution (Popular Science, August 1989)
Some pollutants have direct effects while others act as catalysts or precursors.
The inter-relationships are also more complex than originally assumed.

misc2/
atmospheric pollution

STRATEGIES FOR AGRICULTURE

"In the long run, the most successful approaches will rest on merging individual and societal interests rather than on enforcing the one over the other. This is essentially an institutional, not a technological problem. What is lacking are forms of communication that connect the overarching interest of society in a sustainable agricultural system with the well-being of the individual farmer. Specifically, institutional mechanisms must be devised that correctly signal the emerging social scarcities of land, water and genetic diversity."

Pierre R. Crosson and Norman J. Rosenberg
Resources of the Future, 1989

Fortunately, the right combination of strategies and technologies can reduce the rate of climate change and ameliorate other atmospheric problems at the same time. Why should we care? We already have evidence in Nova Scotia of the effect of acid rain of a local and regional nature on natural resources, particularly fresh water salmonid fish populations, and heritage buildings. The evidence of the effect of chlorofluorocarbons on stratospheric ozone is somewhat circumstantial from laboratory research, computer modelling and some field measurements but the importance of ozone in the protection of fauna and flora from excessive ultra-violet radiation is so great that countries have agreed that we cannot take the risk of reducing the ozone concentration further. There is no local evidence of the effect of ground level ozone on plants and human health. But studies done in more populated areas where smog is prevalent indicates that high oxidant concentrations have caused significant losses to crops and lung disease in people. In Ontario alone, crop losses primarily from ozone are estimated at $20 million per year. Unfortunately there is very little data available on ozone concentrations in Nova Scotia. Measurements in Halifax indicate that ozone concentrations have exceeded maximum acceptable air quality levels on a few occasions. One of the key precursors to ozone, namely nitrogen oxides, are measured in Nova Scotia while volatile organic compounds such as ethylene, benzene and formaldehyde, which also contribute, are not yet measured.

There is now a wide consensus that global warming will occur but there remains debate about the onset of different stages because many factors, some natural, some anthropogenic, can influence the degree and rate of warming. There is also uncertainty about the scope of the impacts. These will likely include sea level rise which affects coastal infrastructure, wetlands, beaches and inshore fisheries. Warmer waters could expand the range of "red tide" resulting in further closure of shellfisheries during the summer months. Rainfall patterns and warmer temperatures will affect agricultural productivity. Nova Scotia could experience an increase in the variety of crops grown but disease and pest problems are also expected to increase. An expansion into less productive soils may be possible with fertilizers.

Gradual changes in forest cover are expected as climate warms. Longer growing seasons would mean increased productivity but, as in agriculture, disease and pests could have an impact. Weather changes elsewhere in the tropical western Atlantic could result in more severe hurricanes whose influence might be felt more often in Nova Scotia. From the point of view of marine transportation, any reductions in sea and ice in the Gulf and St. Lawrence River could have a negative impact on the viability of Halifax ports.

The information base is still incomplete, therefore, it is too early to make predictions with any degree of specificity and accuracy. However there is enough certainty that climate change will occur as a result of atmospheric warming and that some of the changes will be felt in the next 25-50 years that decisions taken today regarding extraction and use of natural resources and energy sources must take it into account.

3. SOIL QUALITY

Soil is a natural resource and its degradation means the depletion of its productive capability. Nova Scotia's soils are naturally acidic, poorly drained, lacking in natural fertility and with a relatively shallow top soil underlain by compact sub-soil (Standing Committee on Agriculture 1984). The total provincial land area in Nova Scotia is 5.3 million hectares, the total agricultural land base is 1.6 million hectares, and of this 178,000 hectares is improved land. Hilchey broke the agricultural land base in Nova Scotia into multi-crop soils, limited use soils, and non-agricultural soils. Multi-crop soils are useful for the commercial producation of a wide range of crops including tree fruits, vegetables, grains, and forage crops. Fifteen areas in Nova Scotia are classified as having multi-use soils and they total 376,640 hectares. Limited use soils constitute 773,674 hectares (Jacques, Whitford and Associates 1985). This classification is very useful for land use planning.

Soil degradation is not perceived as a problem in the province and subsequently the province is lagging behind others in soil conservation initiatives. However a 1985 report entitled Soil Degradation in Nova Scotia estimated that degradation costs the province 17.7 million dollars per year (Jacques, Whitford and Associates 1985).

Given the Nova Scotia Department of Agriculture and Marketing's policy to "develop a more production-oriented approach to self-sufficiency" and a desire to produce more feed grain and vegetable crops in Nova Scotia, soil degradation should be of great concern in terms of the policy's potential effect on soil using current methods of cultivation. The ability of the soil resource to support the policy goals should also be a consideration.

The major concern of farmers and property owners in the province appears to be shoreline and steambank erosion (Webb, K. 1989) and this is also reflected by the media. Unless exacerbated by coastal development, shoreline erosion is a natural process which claims approximately six hectares of agricultural land per year (Webb, K. 1989). Shoreline erosion can be reduced with a large financial investment though rising sea levels and storm surges may offset any mitigative action.

Steambank erosion is also a natural process which from a provincial point of view, in terms of land base, is not considered as a major problem. In most cases the eroded land reappears elsewhere, one notable exception is the formation of mud flats along the Annapolis River. The 1989 Forest/Wildlife Standards and Guidelines may help alleviate this type of erosion through the use of green belts along rivers and streams and other measures to reduce erosion and siltation.

Among soil specialists, soil compaction is a growing concern in Nova Scotia. It is felt that soil compaction may be having an insidious effect throughout the province (Webb, K. 1989). Soil degradation of approximately six thousand hectares of land in King's County under intensive row cropping is being attributed to compaction. Soil compaction occurs when human action such as the use of agricultural equipment produces external pressures which reduces porosity, inhibiting air and water movement and root penetration affecting plant growth. Most row and grain crops in Nova Scotia are grown on loam and sandy loam soils which are susceptible to

compaction. Agriculture Canada is currently in the development stage of a soil quality and monitoring program which will include research into the potential problem of soil compaction in Nova Scotia as well as gathering baseline data on different soil types and their susceptibility to compaction (Webb, K. 1989).

The state of Nova Scotia's soils are not at a crisis stage, however, deterioration appears to be occurring. In order to ensure sustainable agriculture, current soil conservation programs should be expanded and new measures implemented to protect and enhance our soil resource. Presently the Nova Scotia Department of Agriculture and Marketing has legislation and program inititatives in place to protect and improve the provincial agricultural land base (Nova Scotia Land Use Committee 1986) Notable programs are the Limestone Assistance Policy and the Land Evaluation and Planning Service (LEAPS). The Limestone Assistance Policy ensures that soil is not lost to soil acidification and therefore ensures its productivity at least in the short term. LEAPS services mostly mid to large farms. A soil survey is undertaken followed by the recommendations of a soils and crop specialist on crop rotations, field re-orientations, and other methods of maintaining soil productivity while maximizing output Approximately ten farms can be serviced per year, however, demand is greater than the resources of the department will allow. Some scientists and farmers have expressed concern about the long term impact of artificial fertilizers and pesticides on soil quality and productivity but little is actually known about the nature of the problem in Nova Scotia.

It is evident that soil conservation is not perceived as an issue in Nova Scotia by the general public. The government should play a leadership role and bring the growing problem of soil degradation to the attention of the public because it has implications for the sustainability of agricultural production and rural communities It is worth noting that federal and provincial governments seem to recognize the problem and that the new federal-provincial agreement is expected to emphasize soil and water conservation.

4. FORESTS, WILDLIFE AND PARKS

The Department of Lands and Forests protects the forests, wildlife and beaches of Nova Scotia. Initiatives by the department in the past decade have resulted in the Forest Policy of 1986, the Wildlife Policy of 1987, and the Parks Policy of 1988 as well as accompanying legislation which illustrates the government recognition of the importance of these resources and the government commitment to protect and enhance them. The policies also reflect an understanding of the impact of forestry on our wildlife and water resources and an appreciation for the inestimable value that Nova Scotians place on a healthy environment, both in terms of aesthetics and for recreational pursuits.

a) Forests

More than four million hectares of Nova Scotia is forested. The forest must meet the demands of wildlife to ensure its survival, the demands of recreation, and the demands of the forest industry. Often the interests of one conflict with that of another

In addition to land use conflicts involving the province's forests the Royal Commission of Forestry in 1984 concluded that by the year 2005, if current forest practices were maintained, there would not be enough raw material to meed the needs of industry in the seven eastern counties on a sustained yield basis. The resource had been depleted by highgrading, clearcutting, fire, insects, disease, and exploitation. Forestry is the province's largest resource-based industry and while pulpwood constitutes 80 percent of the wood harvested, there are 350 sawmills and woodworking plants and a large number of Christmas tree farmers. The spruce budworm which ravaged the spruce and fir forests, particularly in the Cape Breton Highlands, was aided by a serious age class imbalance of over mature stands more susceptible to disease as well as forestry practices such as clearcutting which favored the regeneration of balsam fir, also highly susceptible to the spruce budworm (Eaton et al. 1986). Today spruce budworm is no longer a threat to our forests. The population experienced a forty percent drop in 1987 followed by another forty percent drop in 1988 (Smith, T.D. and Georgeson, E. 1988). But the advent of plantations of one or more species of similar age classes raises the spectre of pest infestations. These will have to be carefully monitored and preventative strategies should be implemented along ecological lines.

The Royal Commission felt that a long-term management plan was necessary for the forests to ensure that the needs of the forest industry, wildlife, and recreation would be met on a continuing basis. Given the ownership structure of the forest, see Table 5, the long-term management and protection of forest and wildlife resources and critical habitats demands the co-operation and commitment of government, industry, and private owners.

TABLE 5 FOREST OWNERSHIP IN NOVA SCOTIA

Small private	52%
Large private	21%
Crown provincial	24%
federal	3%

Source. Reed, F.L.C. 1987. Nova Scotia Forest Tenures. A Review of Stumpage, Forest Management and Market Access. Nova Scotia Department of Lands and Forests. p. 3.

Management refers to reforestation to replenish the forest and silviculture techniques to increase fibre yield, and to improve the health of the forest by correcting age class imbalances, and maintaining diversity. Management also entails implementing forestry practices to maintain fish and wildlife habitats. Clearcutting is an example of a practice with serious environmental implications. It results in nutrient loss, reduces habitat for many small animals and birds, and increases the siltation of surface waters. The Forest/Wildlife Guidelines and Standards recently published, recommend measures to ensure the protection of wildlife. The Guidelines state that "they are to be implemented on Crown lands" and that the province is committed to maintaining a 65%/35% softwood/hardwood ratio in the province. Due to the situation wherein less than one third of forest lands are in Crown ownership, it is important that private owners also engage in appropriate management practices. Currently only twenty percent of private landowners manage their land (Bailey, E. 1989). This participation must be increased to fifty percent to ensure that the goals of

the forest policy are met. Despite twenty percent participation by private owners, the state of the forests has improved over the past decade. Use of silviculture methods have increased steadily and currently thirty million trees are planted per year. This represents the reforestation of one third of the annual cutover, while it is reported that two thirds of the cutover is regenerated naturally (Bailey, E. 1989).

A 1987 report prepared for the Department of Lands and Forests entitled A Review of Stumpage, Forest Management, and Market Access discusses the constraints on private owners which reduce their opportunities to earn money and therefore to manage their forests. These constraints include traditionally low prices for wood supplied by small landowners, data base deficiencies especially regarding prices and costs and the lack of strategic planning for production and marketing. Cooperative measures to address these constraints by government and landowners should result in incentives to manage private land.

b) Wildlife

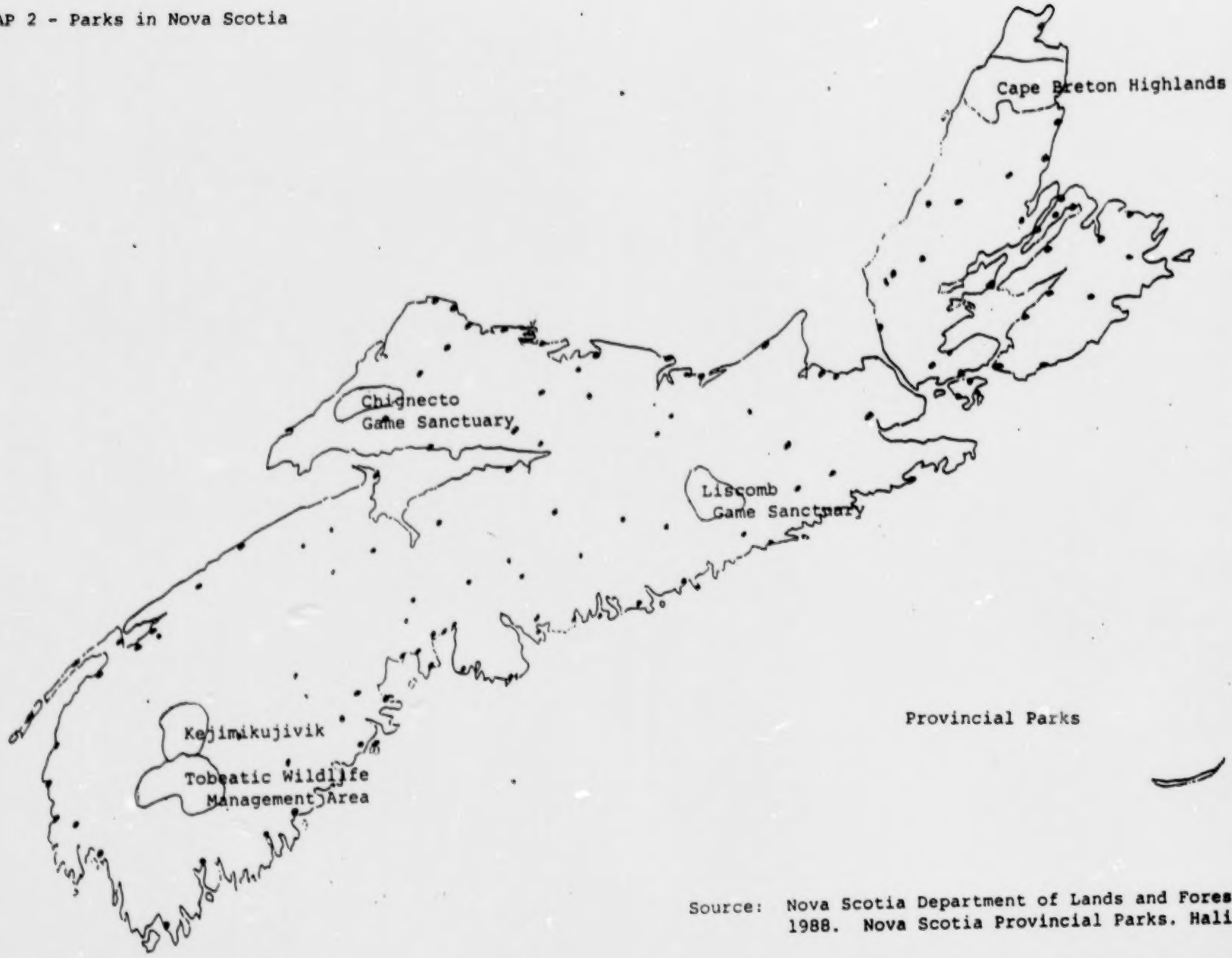
The continued abundance of wildlife is also dependent on the manner in which the forests are treated. Presently in Nova Scotia the state of the wildlife is viewed as satisfactory with species diversity on the increase and no indication that pollution is affecting terrestrial wildlife (Prime, M. 1989), though a limited amount of research is undertaken on this subject. The major concern regarding wildlife is habitat loss, particularly wetlands. A new policy on habitat management was enunciated and there are many programs in place addressing this concern, eg. private organizations - Ducks Unlimited, the provincial government - wildlife management areas, and the federal government - migratory bird sanctuaries. However, it is the incremental impact of many small development projects that must receive greater attention by appropriate government agencies. The problem has been recognized in part and recently Forest/Wildlife Guidelines were issued aimed at reducing habitat destruction in forested areas.

c) Parks and Protected Areas

A relatively new initiative to maintain species diversity is the Special Places Protection Act of 1980 which provides for the protection of valued plants and animals, both rare and representative, on ecological reserves. There are eighty identified candidate sites in the province, two of which have been designated under the act. Twenty or more of these sites are located wholly or in part on Crown land. The Forest/Wildlife Guidelines state that "no forest management activities should occur in or near ecological reserves or candidate special places on Crown land". However these reserves have not been designated for full protection under the Act and it is not known when this will occur (Ogilvie, B. 1989).

Provincial parks provide opportunities for outdoor recreational pursuits as well as a means of protecting the environment and natural resources. Traditionally, Nova Scotia's provincial parks have favoured the provision of recreational facilities, however, the new Parks Policy attempts to move towards the maintenance and enhancement of natural resources as well. The Parks Policy states that as one of its objectives it is directed towards preserving unique, rare or representative elements of the natural environment and scenic landscape. To this end the Department of Lands and Forests has recently put regulations into place to provide for park classification and zoning. Parks will be classified into the following catagories: wildland parks natural heritage reserves, historic parks, natural environmental parks, outdoor

MAP 2 - Parks in Nova Scotia



Source: Nova Scotia Department of Lands and Forests
1988. Nova Scotia Provincial Parks. Halifa

recreation parks, wayside parks, wildlife parks and park reserves. Further, parks will be zoned to distinguish intended land uses including: environmental protection zones, resource conservation zones, and recreational development zones. These initiatives have recently commenced. As can be seen in table 6 and map 2 a significant proportion of Nova Scotia's land base is under some protective status, though some national and international organizations have called for more protected land in all jurisdictions.

TABLE 6 LAND USE IN NOVA SCOTIA

Total Land Area	5.3 million hectares
Forested Land	4.1 million hectares
	- 2.2 mill. ha. softwood
	- 0.7 mill. ha. hardwood
	- 1.2 mill. ha. mixed wood
Protected Areas	
Federal parks	133,206 hectares
National Wildlife Areas	1,915 hectares
Migratory Bird Sanctuaries	5,881 hectares
Ducks Unlimited Sanctuaries	6,564 hectares
Private Bird Sanctuaries	18 hectares
Ecological Reserves - candidate sites	21,312 hectares *
- designated	74 hectares
Provincial	
Wildlife Sanctuaries	950 hectares
Game Sanctuary	73,822 hectares
Wildlife Management Area	53,394 hectares
Provincial Parks	8,848 hectares
TOTAL:	305,984 hectares **

* not yet officially designated
** Accounts for 7.4% of forested land in Nova Scotia

The integrated and complementary planning and policies for the forests, wildlife and parks of Nova Scotia provide the framework for the protection of these valuable resources. Leadership in implementing these policies on Crown lands and education by the government should encourage industry and private individuals in the province to do their utmost in protecting and enhancing these resources. Some interesting initatives have been attempted in the Saint Mary's River watershed and in South western Nova Scotia. These should be explored as models wherein the different players can interact in setting goals for particular geographic units. It is interesting to note that many individuals and environmental groups in the province do not feel that our forestry resource is being protected much less enhanced. There are clearly areas for improvement in consultation, communication on matters related to forests and their use in Nova Scotia, both within the sector and between sectors, but some progress has been made.

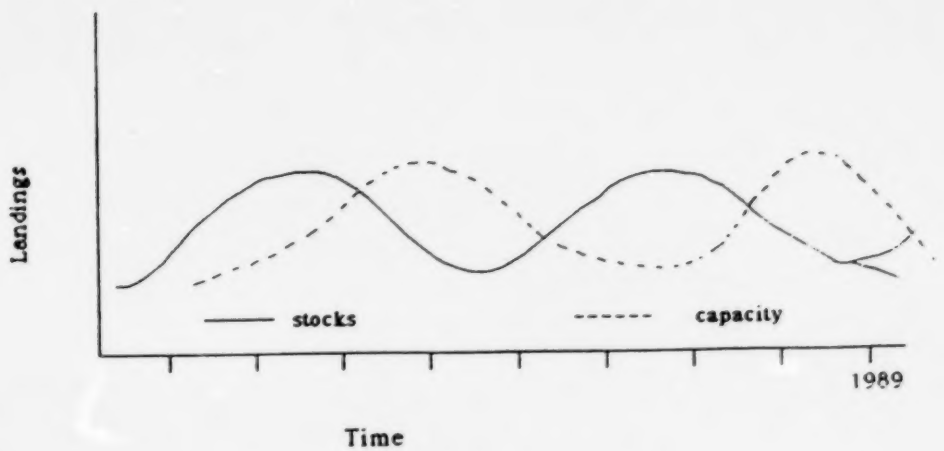
5. FISHERIES

a) Marine Fisheries

The marine fishery in Nova Scotia is important not only to the economy but to our way of life. Inshore and offshore fisheries support 16,000 fishermen, 9,000 fish plant workers, 350 processing plants and 400 fishing port (VanderZwaag, D. et al. 1989). The inland fishery supports the economy through tourism and is valued as a recreational pursuit by many Nova Scotians. These fisheries are being threatened to varying degrees by unsustainable policies from within the fishery management system: overfishing, inadequate date collection, lack of enforcement of laws, some ecological factors that are not well understood, decreased environmental quality, and policies and practices in other sectors of the economy which impact on fisheries. The growth of aquaculture, regarded as a possible solution to decreased conventional harvests (Canada-Fisheries and Oceans 1985), may be stopped in its tracks because of conflicts over ocean use and deteriorating coastal water quality.

The spring of 1989 began with a crisis in Nova Scotia's offshore fishery. The groundfish stocks were reported to be in jeopardy. At the root of the problem of declining stocks is overfishing, catch mis-reporting, processing over capacity as well as the factors mentioned above. The past five years has seen a twenty-seven percent decrease in groundfish quotas for Atlantic Canada dropping 124 million pounds from 459 million pounds in 1984 to 335 million pounds in 1989. Groundfish quotas off southwestern Nova Scotia have fallen from 32 million pounds in 1982 to just over 2 million pounds in 1989. The task force on Northern Cod recommended that quotas for northern cod be cut to 125,000 tonnes in 1990 from 235,000 in 1989. These cuts mean fish plant closings, unemployment and a threat to the traditional way of life in many Nova Scotian fishing communities. Another task force convened by the Minister of Fisheries and Oceans is looking into the current problems in the Southern Nova Scotia-Bay of Fundy fisheries.

Figure 9. The apparent relationship of fish and shellfish stocks and fishing/processing capacity.



While it is excessively simplified, figure 9 represents what appears to occur in the Nova Scotia fishery. The pattern in recent decades has become cyclical. Yet many of the people involved seem surprised by it. Reports of increasing stocks of fish result in considerable pressure by fishermen to permit greater access to stocks and raise quotas. This puts a chain of events into motion in which more boats and larger boats are constructed (all of which must be paid for) more processing facilities are built and others are modernized (all of which must be paid for). Expectation of a rosy future cause fishermen to improve their socio-economic condition by building new homes and purchasing new cars and other consumer goods (all of which must be paid for). There are a limited number of fish in the sea but unfortunately, it would appear, an unlimited capacity to harvest them.

The present crisis is evidence that there are serious problems with fish management in Atlantic Canada. The 1989 Nova Scotia Fisheries Policy calls for alternatives to the complex management system, particularly as applied to the inshore fleet for more sustained use of the resource. Representatives of major fishing companies, an independent producers association, and a draggermen's association among others making presentations to a Ministerial Task Force, also recently called for substantial changes in the way the Scotian Shelf fishery is conducted and managed. These included improved utilization of the fleet, delivery of higher quality fish to processing plants, encouragement of less destructive fishing practices, enhanced protection of species and stocks, provision of more stable employment, and reduced taxpayer support for the fishery in general. Press reports indicate that there is consensus building on the objectives for the marine fishery of the Scotia Fundy area Besides institutional management changes, management must also be seen to include protection and restoration of fish habitat (VanderZwaag, D. et al. 1989). Coastal and marine water quality is deteriorating and this, along with development, is contributing to fish habitat destruction along the coasts. Also in order for management of the fishery to be successful and ensure a sustained resource much more research is required into biology and oceanography of marine ecosystems in order to calculate quotas.

b) Aquaculture

Because of the crisis in the marine fisheries, aquaculture would appear to be a promising alternative. Aquaculture has not been developed in the province to the extent it might be, mostly due to ocean use conflicts. There has been a great deal of opposition to aquaculture proposals particularly in the southwestern portion of the province. Opponents feel it may interfere with recreational pursuits, aesthetics, and their own harvest of the ocean's bounty.

Deteriorating coastal water quality also poses a great threat to the potential for aquaculture in Nova Scotia. Aquaculture depends on clean marine waters. Presently there are 160 shellfish closures in Nova Scotia. These closures have been increasing since the 1960's indicating that marine water quality is definitely not improving.

Despite the barriers facing aquaculture there are 400 active sites in Nova Scotia which cultivate salmon, trout, mussels, oysters, and Irish moss. The potential for cultivation of bay scallops, sea scallops, quahogs, and beer clams is being evaluated. The potential and growing need for aquaculture (more than 200 applications are being considered) may provide a suitable incentive to prevent further coastal water deterioration and restore contaminated areas.

c) Freshwater Fisheries

Inland fishery stocks have also shown a definite decrease over the past decade. There is little quantitative evidence to support this but ample anecdotal evidence from sport fishermen (MacLeod, L. 1989). The effects of acid precipitation on the inland fishery have been well documented and are discussed in a previous section. Declines in salmon and trout production in southwestern Nova Scotia are attributed, at least in part, to acid precipitation. The other major threats to the inland fishery are overfishing, considered to be the greatest threat, land use in general, particularly increased access to lakes and rivers brought about by forestry access roads, cottage development and availability of various types of all-terrain vehicles, and finally sewage and agricultural run-off (MacLeod, L. 1989). In the summer of 1988 eleven major fish kills were reported in steams, brooks, and rivers in the Annapolis Valley alone, all were caused by agricultural run-off presumably high in chemical fertilizers and/or pesticides. Sewage and agricultural run-off is also contributing to the eutrophication of many rivers in the province, the Annapolis/Cornwallis being the most notable example.

To alleviate these pressures and restore the inland fishery, the Department of Fisheries is in the process of developing an inland management scheme which will divide the province into zones to be managed through advisory councils made up of government and interested parties. There is also a move to divert fishermen from trout species subjected to less fishing pressure (MacLeod, L. 1989). Education and awareness of the problem is also necessary to solve it.

The fisheries of Nova Scotia, both sea and inland, generate many tourist dollars. Of particular importance in the draw of tourists to Nova Scotia are its fishing villages. A sustained fishery is necessary for continued tourism, one of the fastest growing sectors in the provincial economy. Tourism also depends on a healthy overall environment. The fisheries and resource based tourism are alike in that they are both impacted by decisions made in other sectors of the economy from agriculture to forestry to public works.

Shellfish closures and inland fish kills indicate that more intersectoral consideration must be given when formulating policies and engaging in practices in what are obviously not totally independent sectors.

In the case of marine fisheries, a greater degree of intrasectoral coordination is required as the practices of other sectors have much less impact than do those within the sector on the sustainability of the industry and the fishing communities.

STRATEGIES FOR SUSTAINABLE ECONOMIC DEVELOPMENT

"A nation's annual budget establishes the framework of economic and fiscal incentives and disincentives within which corporate leaders, businessmen, farmers and consumers make decisions. It is perhaps the most environmental policy statement that any government makes in any year, because in their aggregate, these decisions serve to enhance or degrade the nation's environment and to increase or reduce its stock of ecological capital."

Jim MacNeill
Institute for Research on
Public Policy, 1989

NOVA SCOTIANS SPEAK OUT ABOUT THE ISSUES

A survey of 21 leaders from government, industry, non-government organizations and the academic community eliciting opinions on important environmental quality and natural resource issues revealed water quality as the overriding environmental quality issue and equal concern over forestry and fisheries management. The whole approach to dealing with environmental problems and natural resource management was also signalled as an issue with the concepts of sustainable development, land use planning, public involvement, and proactive planning mentioned. There is also a general feeling that despite the rhetoric paid to the environment by the provincial government there has been little concrete action and an urgent need for the same.

Following the same categories for environmental quality and natural resource issues used in this document a rough tabulation indicates the general areas of concern: water quality 13, air quality 6, forestry 5, habitat protection 2, fisheries 5, soil 0. The issues of waste disposal and recycling 4, and climate change 4 were also raised to a significant degree.

With respect to water quality, concern over coastal and groundwater quality exceeded that for surface waters. In the area of air quality and tied in with surface water quality was the overriding concern over acid precipitation and its effects on our freshwater fishery. Overexploitation of our forestry and fishery resources and the need for new management schemes constituted the majority of concern in these areas. The use of pesticides and herbicides in forestry and agriculture was also mentioned, in particular, their potential to contaminate water. Interestingly soil conservation was not raised as an issue by any of the individuals contacted.

It was emphasized by one individual that Nova Scotians cannot correctly identify and priorize the issues because there is a gross inadequacy of information. Lack of adequate information upon which to base sound decisions is an issues in itself. An example of the consequences of inadequate information is the recent crisis in the northern cod stocks. Current information and monitoring is required to determine present problems and to prevent future ones.

There was a general feeling that Nova Scotians in general, and government and industry in particular, are much more aware of environmental problems but are not translating this awareness into concrete action. Sustainable development is a concept that government and industry have not come to terms with. There seems to be a perceived paradox between our need for development in terms of more industry and jobs, and protecting our environment. However the two are not mutually exclusive.

To ensure environmental quality and natural resources are protected and enhanced while striving to improve the provincial economy will require new methods of strategic long term planning. It is felt there needs to be a definite shift from short-term reactive planning to long-term proactive planning. Public consultation and integrated land use planning were identified to facilitate and improve this process.

Many individuals expressed hopeful optimism at recent initiatives by the Departments of Lands and Forests and Environment in the realm of resource and environmental protection. However, it is also felt, as expressed by one individual, that there is a tremendous reluctance, especially by the Department of Environment to regulate and enforce controls and standards. Guidelines and standards are the norm for environmental protection in Nova Scotia rather than regulations and legislation.

Generally speaking, the key informants used in this survey want:

- to maintain the good quality of life in the province;
- to see a more active, forward looking approach to the protection and management of the environment;
- to see more leadership on the part of the provincial government;
- a user pay approach and the incorporation of environmental costs into projects and products.

These findings are consistent with results of similar surveys conducted by a wide variety of agencies and organizations in recent months. A recent survey conducted by Synergistics Ltd. for Environment Canada in March of this year found that:

- environmental issues and sustainable development will have a lasting influence on the political and public agenda;
- awareness of these issues among influential decision-makers is high;
- for some, sustainable development is equated with environmental protection;
- in these cases, response is considered adequate if government-imposed regulations are satisfied;
- there is a recognition that the public must be better informed and that corporate attitudes can inhibit progress in this area;
- There is a lack of political will and appropriate financial incentives;
- the media exaggerates public fears rather than informing the public.

It is clear that much remains to be done in educating everyone. It is also clear as stated by Synergistics, that change will be a slow and difficult process.

ISSUES AND OPPORTUNITES FOR THE FUTURE

From a population and pollution standpoint, Nova Scotia as a whole is a relatively small source of transboundary pollutants. For example, in terms of air pollution, preventive and mitigative action in Nova Scotia will not necessarily result in any significant beneficial impact on the quality of our air (except perhaps in certain localities). The reason is that we are downwind of much larger sources of emissions in the northeastern United States and the Great Lakes industrial areas of both countries. In addition, global warming is a hemispheric and global problem rather than a provincial or local one. On the other hand, other issues such as water quality and soil conservation are largely under the control of government, industries and individuals in Nova Scotia. Obviously some factors, especially those of an economic nature, are influenced by activities and programs outside our immediate control. But the argument often presented that action in Nova Scotia is of little direct significance is not the appropriate one to use when discussing environmentally sound economic development. Rather the **per capita impact on the natural environment due to demands and expectations is the relevant measure**. As individuals we consume or transform more energy and matter, and generate more waste then almost all other human populations on the earth. (See Appendix A for Consumption Patterns in Nova Scotia.) The industrialized countries represent less than 25% of the world's population and yet they utilize 75% of the resources. And we appear to expect that we will be able to do so indefinitely.

While we have created some serious pollution and resource management problems of our own, many of them are actually solvable with little or no impact on our overall standard of living. The greater threat to the environment and our way of life is that we have created an economic and industrial system to which less developed countries also aspire. It would not be morally acceptable to suggest that the Third World could not industrialize and grow economically as we have done. But that growth will surely result in substantial increases in carbon dioxide and other gases which will accelerate climate change, more aquatic and airborne pollutants of all types, increased deforestation leading to losses of plant and animal species with potential medical and biotechnological benefits, increased desertification in areas prone to the phenomenon and pressure for large transmigrations of people between countries and continents.

These are problems of great magnitude and severity and we in the more industrialized countries must find the conviction and the means to resolve them. There is no reason why Nova Scotia cannot demonstrate leadership in this regard. **There are ethical reasons for doing so, there is the matter of self-preservation, but there are also opportunities**. Developed countries must find ways to live more lightly on the earth, to live off the interest rather than the natural resource capital. The ultimate measure of that approach is the per capita use and waste of energy and materials. Ways and means must be found to become more effective and efficient in our use of energy and materials

One model, which might be used for discussion purposes, is that of a home, an industrial facility or a community under a bubble. The bubble could be composed of a semi-permeable membrane which permits some raw materials to enter but limits the wastes which can be discharged. This is more or less the application of the picture of the earth within its atmospheric envelope, its bubble, to development units of different

scales. **This model implies that efforts would have to be made to minimize input, thereby ensuring that the assimilative capacity of the unit under the bubble is not exceeded.** It also necessitates a comprehensive approach to management of wastes including waste waters, solid wastes, hazardous wastes and heat. In this context, the wastes of one facility or establishment could become the raw materials for another, thereby reducing the overall energy and material costs of the community or industrial park. As a matter of policy, new industrial parks could be designed and constructed with this model in mind. Current and future air quality problems are linked inextricably to energy production and use. New technologies can be fostered to produce energy with less waste to the atmosphere and conservation measures can have a significant impact on energy production and transportation. In some juristictions, electric utilities are playing a lead role in promoting conservation. Clearly in terms of sustainable development, the emphasis must shift to demand management in the energy sector from that of supply management.

Many new commercial and industrial opportunities will emerge in recycling operations, research and development of new technologies and products, manufacturers of more efficient equipment, consultants as well as educators and trainers. Deterioration of the environment is now a primary concern in industrialized countries, less developed countries, the West and the East, regional and international organizations. This concern with its focus on environmentally sustainable social and economic development will translate into pressure to do much more than apply traditional environmental protection measures and technologies. **Those who conceive, design, and where necessary manufacture, the techniques and the technologies that will permit resource extraction, transportation, manufacturing energy production to occur in a more efficient and effective way, in environmental terms, will reap substantial rewards.** The markets of the less developed countries will be open to them.

In part because of the large number of commercial chemicals in use today (100,000) and the inability of governments to address the concerns of the public in an acceptable manner, pressure will mount to restrict uses and punish misuses. This will apply particularly to pesticides. Forestry and agriculture will have to adapt to this situation. **These industrial sectors will have to make greater use of integrated pest management strategies and look more carefully at the impact of forest management practices.** And to make matters more difficult, these sectors will also, in all probability, have to adapt to a changing climate. While it is too early to define the rate of the changes and to accurately predict whether conditions will be drier or wetter in Nova Scotia, planning must begin now to consider appropriate strategies. The lead time to effect changes in the agriculture may not be as long as in the case of forestry but traditions may well be harder to break in the former.

It is more difficult at this time to predict the influence of sea level and temperature rise on oceanographic conditions and the fisheries. But there are more serious, shorter term issues to address in the fishery. Recently a blueprint was proposed for the Scotian Shelf fishery by a major fishing company. Press reports following the release of their proposal indicate that some elements of the fishing industry disagree with the details. However, when compared to the criteria listed in the introduction of this paper, the objectives outlined sound very much like a call for sustainable development of the fishery. The past will tell us that it is much easier to talk about and set objectives for sustainability than it is to put the concept into practice

This is especially true in the case of marine fisheries and yet government, fishing companies and fishermen have been talking about sustained yield for many years. Government imposed regulation is necessary but the current system is highly complex and costly. More research is needed on the dynamics of the resource and the factors which influence productivity, distribution. Innovative management approaches must be tried.

At least one component of the fishery sector, aquaculture, may continue to hold promise for the future as long as its promoters keep the capacity under control and governments maintain the quality of the waters in coastal bays and harbours at a high level.

We must come to grips with the dichotomy in the fisheries and forestry sectors of the individual versus the large industrial enterprise. Negotiation via the media as has occurred with great regularity over the past few months in both sectors, underlies some serious differences of values and objectives. Human resources must be used more constructively to resolve these differences. The conflicts in the fishery are perhaps exacerbated by the downturn in the fish stocks and quotas and by the lack of property rights, but many of the same problems are raised time and again by parties in both sectors. Have they been talking at cross purposes? Have they defined sustainability differently? Can a cooperative management system be put into place based on some broadly-based participatory process to develop objectives?

While large industrial operations have been viewed as a measure of economic prosperity, such facilities, whether coal or metal mines, tire manufacturing plants, tend to have large environmental imprints. It is true that environmental impact assessment processes will place such facilities under increasing scrutiny but seldom are the overall environmental costs of these facilities actually considered. Many are taken as given and accepted without question. **Studies of the impact of new industries will become more comprehensive with longer time horizons for the evaluation of effects.**

Nova Scotia could become a haven for sustainable economic development projects by adopting a "small is beautiful" approach. **Such an approach would involve developing products and services for specific, select markets not only in North America but abroad.** An effort could be made to foster the establishment of such small industries throughout Nova Scotia in part to sustain communities while maintaining the capacity of the environment to assimilate the negative impacts of industrial development. Though there are risks associated with these small innovative operations, Nova Scotia has a number of successes which can serve as models. Yesterday's News, Suttles and Seawinds, Peninsula Farm, and the new plant producing fish skin products are good examples. The reasons for those successes should be carefully assessed. In the year 2000, many such industries, some involved in high tech, others finding new ways to use waste materials, may be in operation from Yarmouth to Sydney.

By the year 2000, there should be environmental curricula at all levels of the school system as well as a variety of support materials for teachers and students. Environmental issues provide excellent opportunities to relate different disciplines and different perspectives to one another. It is becoming increasingly important for students to understand ecological imperatives the nature of

the apparent environment and development conflicts, and the ethical or moral considerations involved in seeking sustainable devleopment. Some teachers and non-government organizations have compiled materials for use in the classroom but these represent an informal and piecemeal approach to environmental education. A conference of educators and experts should be convened for the sole purpose of setting objectives, developing curricula compiling materials and identifying related needs for an integrated environmental education program in Nova Scotia.

Finally, one of the major difficulties in preparing this paper was the lack of any comprehensive information system on the state of Nova Scotia's environment. Such a system supported by appropriate data bases is needed to permit an evaluation of progress and to set goals for the future. While we can all point to some successes, it is not possible to determine whether environmental policies and programs are having any significant impact on the nature of development in the province. When will we know when we are on the road to environmentally sustainable economics and social development? When will we know whether we have reached particular milestones?

This change may well translate into a different type of economic growth, a different way of living. It does not necessarily translate into a future with no growth or a lower standard of living. The indicators which we have traditionally used may have to change, there may be dislocations in some industrial sectors and many consumer items may well reflect the real costs to the environment. See Table 7 for some examples of the real costs of environmental deterioration and enhancement in Nova Scotia.

TABLE 7 COSTS OF ENVIRONMENTAL DETERIORATION AND ENHANCEMENT IN NOVA SCOTIA

- shellfish closures in the Annapolis Basin due to decal pollution have resulted in 50% reduction in the harvesting potential, this represents over a two million dollar loss. (Menon, A.S. 1988)

- overall impact of shellfish closures has resulted in the loss of unquantifiable millions to the fisheries. (Menon, A.S. 1988)

- the value per landed salmon to the eastern Canadian economy is $100/fish, based on pre-acidification Atlantic salmon production capacity in the southern upland region of Nova Scotia at an angling catch of 13% loss of salmon represents a loss of $285,000 per year. (Watt, W.D. 1986)

- costs of acid precipitation on buildings and materials is unquantified.

- total estimated cost for a 20 year de-acidifying project (liming to restore pre-acidification production) of Atlantic salmon habitat of the southern upland region of Nova Scotia is $95,000,000 or $400/restored salmon. (Watt, W.D. 1986)

- direct forest rehabilitation will require over $20,000,000 annually. (Royal Commission on Forestry 1984)

- cost of covering Metropolitan Authority landfill with clay will be $1 million, the entire closure can be estimated at a few million dollars. (MacEachern, R. 1989)

- it would not be unreasonable to estimate the cost of creating a new landfill site for the Metropolitan Authority at 10 million dollars, this includes public consultation, assessing the land, purchase of the land, and preparation. (MacEachern, R. 1989)

- to improve and implement sewage treatment facilities across Nova Scotia would cost $250 million in capital costs alone (Municipal Affairs)

CONCLUSION

As a barometer of the profile of the issue and public interest, the media in Nova Scotia has expanded its coverage of environmental issues. Coverage is becoming more analytical and informative but there remains a tendency to sensationalize as seen in a recent headline describing Halifax Harbour as a "cancer cesspool".

Progress has been made in several other areas including new resource management policies for forestry, fisheries, parks and wildlife, new legislative initiatives to protect the natural environment and human health and new consultative mechanisms such as the Round Table and advisory councils. However, a number of problems require concerted action in the area of water quality, air quality where it is the cummulative impacts of many apparently independent activities which are interfering with the sustainability of those resources. More investigation is required into the long term implications of some agricultural, fisheries and forestry practices on the sustainability of the resources involved. In those cases, it is the intrasectoral activities and conflicts which appear to threaten the sustainability of the resource base. The problems are generally recognized by opinion leaders in the province and with the increasing attention focussed on the environment by individuals, industrialists and politicians, it is anticipated that more extensive and integrated policies and programs will be forthcoming. As the people of Nova Scotia reflect on natural resource and environmental issues and take note of new initiatives and successes which have occurred, there are a number of questions that should be considered as we move toward a sustainable future.

1. Should a visionary environmental policy be established for Nova Scotia? What elements should be included in such a policy?

2. Should Nova Scotia adopt a more comprehensive, yet flexible, approach to pollution prevention and control by integrating standard regulatory measures with financial incentives?

3. How can government agencies and private companies be encouraged to promote and implement environmentally sound policies and practices?

4. The prices of many products currently purchased by consumers and industries are artificially low due to direct and indirect subsidies. Should the true costs (including environmental costs) of food, water and electricity be reflected in the products we purchase?

5. Should Nova Scotia adopt an explicit risk management approach to the prevention and resolution of environmental problems? If so, how should government and industry respond to the threat of global warming?

6. Can the interests of large companies, eg, Stora Forest Industries and National Sea Products, be reconciled with those of small woodlot owners and inshore fishermen? How should this be done?

7. Should the provincial government issue a regular state of the environment report? Who should prepare such a report?

8. Formal environmental education programs are lacking in Nova Scotia. Should such programs be developed and where do the priorities lie?

9. How much public participation is enough in the reviews of policies and development projects?

10. The public and some municipalities are interested in recycling but the support infrastructure is not yet in place on the part of government and industry What kind of incentives are required to foster recycling province-wide?

11. Should Nova Scotia foster a strong environment industries sector to take advantage of opportunities in the developing world?

12. Should the provincial government encourage and support a wide range of demonstration projects on environmentally sound sustainable development?

13. The provincial economic development strategy, originally released in 1984, iscurrently being revised. Should conference participants call on the government to i) delay its release in order to incorporate it into a broader sustainable development strategy, or ii) expand the environmental dimensions in the current review?

14. What are elements of the successful ventures of companies that should be fostered?

15. What are elements of successful cooperation by government agencies, private industries and community groups that should be fostered?

16. How can integrated pest management become the rule rather than the exception in Nova Scotia's agriculture sector?

17. While large scale clearcuts and pesticides may be effective tools in forest management, what can be done to reduce their use in Nova Scotia?

18. How can all sectors of the fishing industry be made to understand that strict conservation strategies must be implemented over the long term?

19. How do we change the role of energy from being the development to that of supporting development in an environmentally sound manner?

20. What incentives can be used to promote greater energy efficiency in manufacturing, transportation, consumer products?

Clearly each of these questions will not be answered during the Conference on Building Partnerships for Environmentally Sound Development. The process of redefining development and setting a different course will not be completed in a matter of days or weeks. It remains, however, for the participants to take a few steps by agreeing on some general goals and some measures of sustainability which might give us a vision of Nova Scotia in the year 2000.

TOWARD A SUSTAINABLE WORLD

"Sustainability is the nascent doctrine that economic growth and development must take place, and be maintained over time, within the limits set by ecology in the broadest sense - by the interrelations of human beings and their works, the biosphere and the physical and chemicals laws that govern it. The doctrine of sustainability holds too that the spread of a reasonable level of prosperity and security to the less developed nations in essential to protecting ecological balance and hence essential to the continued prosperity of the wealthy nations."

William D. Ruckelshaus
Browning Ferris Industries, 1989

SELECTED REFERENCES

Annual Reports. Nova Scotia Departments of Lands and Forests, Agriculture and Marketing, Mines and Energy, Environment, Fisheries and Transportation.

Canada. Environment Canada-Conservation and Protection. 1988. Effects of Acid Rain on Atlantic Canada's Inland Waters. Dartmouth

Canada. Environment Canada. 1984. Energy Demand/Supply (1984-2000) in Atlantic Canada. Environmental Implications and Opportunities for Environment Canada. Dartmouth

Canada. Environment Canada. 1983-1986. National Air Pollution Surveillance-Annual Summary. Ottawa

Canada. National Inventory of Municipal Waterworks and Wastewater Systems in Canada. 1981 and 1986. Ottawa.

Canada. Standing Committee on Agriculture, Fisheries, and Forestry. 1984. Soil at Risk. Ottawa.

Eaton, P.B., Hildebrand, L.P., and d'Entremont, A.A. 1986. Environmental Quality in the Atlantic Region 1985. Environment Canada-Environmental Protection Service. Dartmouth.

Hare, F.K.H. 1989. Canada and the Changing Atmosphere. Canadian Meteorological and Oceanographic Society.

Jacques, Whitford and Associates. 1985. Soil Degradation in Nova Scotia. Agriculture Canada.

Kuhnke, D.H. 1989. Silviculture Statistics for Canada: An 11-year Summary. Forestry Canada. Edmonton.

Mail Star. October 1, 1988. Weekend Journal Special Report on Pollution in Nova Scotia. p. 32-39. Halifax.

Menon, A.S. 1988. Molluscan shellfish and water quality problems in Atlantic Canada. Toxicity Assessment: An International Journal. 3:679-686.

Nova Scotia. Department of Agriculture and Marketing. 1989. Summary of Assistance Policies. Halifax.

Nova Scotia. Department of Environment. 1987. Abandoned Waste Disposal Site Study. Halifax.

Nova Scotia. Department of Fisheries. 1989. Fisheries Policy. Halifax.

Nova Scotia. Department of Lands and Forests. 1989. Forest/Wildlife Guidelines and Standards for Nova Scotia. Halifax.

Nova Scotia. Department of Lands and Forests. 1986. Forestry: A New Policy for Nova Scotia. Halifax.

Nova Scotia. Department of Lands and Forests. 1984. Forestry: Report of the Nova Scotia Royal Commission on Forestry. Halifax.

Nova Scotia. Department of Lands and Forests. 1988. Parks: A New Policy for Nova Scotia. Halifax.

Nova Scotia. Department of Lands and Forests. 1987. Wildlife: A New Policy for Nova Scotia. Halifax.

Nova Scotia Land Use Policy Committee. 1986. An Inventory of Provincial Initiatives which Complement the World Conservation Strategy in Nova Scotia. Halifax.

Nova Scotia Land Use Policy Committee. 1984. An Overview of Activities Affecting Wildlife Habitats in Nova Scotia. Halifax.

Reed, F.L.C. 1987. Nova Scotia Forest Tenures. A Review of Stumpage, Forest Management and Market Access. Nova Scotia Department of Lands and Forests. Halifax.

School for Resource and Environmental Studies, 1987. Toward a Conservation Strategy for the People and Resources of Nova Scotia. Dalhousie University. Halifax.

Smith, T.D. and Georgeson, E. 1988. Spruce Budworm Population in Nova Scotia 1988. Nova Scotia Department of Lands and Forests. Truro.

Synergistics Consultant Limited. 1989. Sustainable Development: Views of Canadian Decision-Makers. Submitted to Corporate Policy Group, Environment Canada. March.

Watt, W.D. 1986. A summary of the impact of acid rain on Atlantic salmon in Canada. Water, Air and Soil Pollution. 35:27-35.

VanderZwaag, D., Stokoe, P., Lamson, C., and Côté, R. 1989. In Search of Sustainable Development in Nova Scotia's Fisheries: Jigging in a Raging Sea. Unpublished.

PERSONAL COMMUNICATIONS

Bailey, E. Nova Scotia Department of Lands and Forests.

Barbour, S. Canada. Department of Fisheries and Oceans.

Borgall, D. Environmental Chemistry Laboratory. Victoria General Hospital.

Casey, P. Nova Scotia Department of Health.

Ducharne, A. Canada. Department of Fisheries and Oceans.

Duggan, L. Halifax Water Commission.

Fitzner, R. Nova Scotia Department of the Environment.

Langman, M. Nova Scotia Department of Agriculture and Marketing. Truro.

MacEachern, R. Halifax Metropolitan Authority.

MacLeod, L. Nova Scotia Department of Fisheries.

Moerman, D. Nova Scotia Department of Agriculture and Marketing. Truro.

Moores, B. Environment Canada. Air and Water Quality Branch. Dartmouth.

Ogilvie, B. Nova Scotia Department of Education. Curator of Special Places.

Prime, M. Nova Scotia Department of Lands and Forests. Director of Wildlife.

Smith, D. Nova Scotia Department of Lands and Forests. Manager of Park Planning-Provincial Parks Division.

Webb, K. Canada. Agriculture Canada. Truro.

Wollerville, P. Nova Scotia Department of Lands and Forests.

APPENDIX A - CONSUMPTION PATTERNS IN NOVA SCOTIA

TABLE III - REGISTRY OF MOTOR VEHICLES IN NOVA SCOTIA

Registry of Motor Vehicles		New Vehicles		
Year	Total Vehicles	Passenger	Commercial	Total
77/78	456,045	39,982	13,279	53,261
78/79	492,990	42,491	16,819	59,310
79/80	543,009	42,222	15,304	57,546
80/81	566,600	41,068	12,350	43,418
81/82	570,009	37,267	10,181	47,448
82/83	575,502	34,647	9,030	43,677
83/84	605,947	34,840	9,714	44,554
84/85*	508,365	37,608	11,402	49,010
85/86	514,230	41,735	12,927	54,662
86/87	553,520	38,754	13,477	52,231

* program adjusted in September 1984 to reflect changes in reported figures due to duplications of recording fees and registration fees.
Source: Annual Reports. Nova Scotia Department of Transportation for the years 79 to 87 ending March 31.

TABLE I - POPULATION OF NOVA SCOTIA

Year	Population
1978	828,571
1979	828,571
1980	828,571
1981	847,442
1982	847,442
1983	847,442
1984	847,442
1985	847,442
1986	873,176
1987	873,176
1988	877,851
1989	882,127
1990	886,228
1991	890,113

Source: Nova Scotia Department of Municipal Affairs. 1987. Annual Report of Municipal Statistics.

TABLE II - PROVINCIAL GROSS DOMESTIC PRODUCT in millions of dollars

Year	Income Based	Expenditure Based
1978	5,569	7,750
1979	6,093	8,583
1980	6,292	9,442
1981	7,345	10,915
1982	8,462	12,179
1983	9,629	13,604
1984	10,707	14,795
1985	11,670	15,993
1986	12,578	16,833
1987	13,374	17,677

Source: Statistics Canada. 1988. Provincial Economic Accounts Historical Issue 1961-1986.

TABLE IV -SALE OF ALCOHOLIC BEVERAGES BY VOLUME thousands of litres

Year	Volume
1978	74,009
1979	74,783
1980	74,711
1981	73,404
1982	72,850
1983	73,598
1984	76,221
1985	75,746
1986	73,988

Source: Statistics Canada. 1978-1986. The Control and Sale of Alcoholic Beverages in Canada.

TABLE V -TOTAL END USE ENERGY CONSUMPTION IN NOVA SCOTIA

Year	Energy in trillion BTUs
1979	199.6
1980	200.2
1981	170.5
1982	163.6
1983	166.2
1984	165.8
1985	160.9
1986	162.4
1987	170.1

Source: Nova Scotia Department of Mines and Energy.

TABLE VI - HALIFAX WATER CONSUMPTION PER CAPITA PER DAY in imperial gallons

Year	Consumption	Population
1978	131	145,546
1979	127	148,457
1980	129	151,426
1981	132	142,132
1982	131	144,130
1983	131	147,013
1984	125	149,783
1985	124	152,884
1986	116	161,525

Source: Halifax Water Commission.

TABLE VII - FUTURE WASTE GENERATION

	1986	2001	2006
Population	306,423	375,010	394,510
Total Solid Waste Generated (tons)	276,231	522,800	655,600
Per Capita Generation Rate (pounds/year)	5.02	7.6	9.1

Porter Dillon. 1987. Solid Waste Blueprint. Halifax

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